

# MONTHLY WEATHER REVIEW,

## SEPTEMBER, 1877.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

### INTRODUCTION.

The present REVIEW for the month of September depends upon all data received up to the 14th of October from the Canadian Meteorological Service, the United States Navy, the Army Post Surgeons, Voluntary Observers and the United States Signal Service. The most interesting features have been: First, the cyclones of the Gulf of Mexico and of the Caribbean Sea. Second, the drought and prairie fires of certain regions. Third, the universal high temperature.

### BAROMETRIC PRESSURE.

*In General.*—The general distribution of atmospheric pressure for the month is shown by the isobars on Map No. II, from which it appears that the area of highest pressure, 30.05, covers the Middle Atlantic States and southern New England. In September, 1871, the area of highest pressure, 30.15, covered the greater part of the region from Missouri to the Alleghanies. In September, 1872, the highest pressure, 30.05, covered the South Atlantic States. In September, 1873 and 1874, the area of 30.05 to 30.10 covered the South Atlantic, East Gulf, and Middle Atlantic States. In September, 1875, the area 30.05 covered the South Atlantic and East Gulf States; but in September, 1876, the pressure of 30.05 is found only in a small portion of northern Louisiana. On the average, therefore, the pressures for 1877 have been below the normal in the Gulf States and in the extreme Northwest, but have agreed with the normals in the Middle Atlantic States.

*Barometric Ranges.*—The general range of pressure is shown by the following table, from which it appears that for the whole country a range of 1.06 inches has been recorded:

LOW AREAS.				HIGH AREAS.			
No.	Location.	Date.	Minimum Pressure.	No.	Location.	Date.	Maximum Pressure.
I	Mouth St. Lawrence.....	Sept. 1st, 7:35 a. m.....	29.56	I	Lower Missouri valley..	Sept. 2nd, 7:35 a. m.....	30.26
II	Southern Minnesota.....	Sept. 4th, 4:35 p. m.....	29.75	II	Lower St. Lawrence val..	Sept. 7th, 7:35 a. m.....	30.49
III	Missouri.....	Sept. 9, 7:35 a. m. 4:35 p. m.	29.61	III	Lower Missouri valley..	Sept. 17th, 7:35 a. m.....	30.31
IV	Manitoba.....	Sept. 11th, 4:35 p. m.....	29.44	IV	Middle Atlantic States..	Sept. 23rd, 7:35 a. m.....	30.35
V	Manitoba.....	Sept. 13th, 4:35 p. m.....	29.37				
VI	Louisiana.....	Sept. 18th, 4:35 & 11 p. m.	29.43				
VII	Nova Scotia.....	Sept. 21st, 11 p. m.....	29.45				
VIII	Minnesota.....	Sept. 21st, 4:35 p. m.....	29.52				
IX	Minnesota.....	Sept. 24th, 11 p. m.....	29.79				
X	Dakota.....	Sept. 26th, 4:35 p. m.....	29.60				
XI	Cape Hatteras.....	Sept. 26th, 4:35 p. m.....	29.56				
XII	Minnesota.....	Sept. 29th, 4:35 p. m.....	29.36				

The local barometric ranges have been as follows: *Large Ranges*—Bismarck, 1.01; Breckenridge, 0.95; Boise City, 0.96; North Platte, 1.00. *Small Ranges*—Cambridge City, Tex., 0.31; Corsicana, 0.36; Pilot Point, 0.38; San Francisco, 0.34; Santa Fe, 0.29; Shreveport, 0.32; San Antonio, 0.37; Vicksburg, 0.33.

*Areas of High Pressure.*—In general but few high areas have been reported, and none of these presented cases of very high pressures.

No. I.—extended on the 1st, 2nd and 3rd from the Northwest slowly southeastward to the Gulf States, and thence eastward, reaching the South Atlantic coast on the 4th.

No. II.—covered British America on the 5th, and on the 6th had moved eastward to the St. Lawrence valley. On the 7th it moved southward over the Middle States and New England, producing high north-east winds on the coast, while the central highest pressure continued until the 9th to occupy the St. Lawrence valley, where the barometer fell on the 10th, and the highest pressure was transferred to the Middle Atlantic coast, where it remained, with slight variations, until the 13th.

No. III.—The pressure continued highest along the Atlantic coast from Florida to Newfoundland until the 16th, on which date an area of rising barometer and cool northerly winds extended rapidly southward from Oregon and Manitoba to California, Arizona and Kansas, apparently induced by the low barometer and cyclone that then prevailed in the Gulf of Mexico. The highest pressure was, on the 17th, 7:35 a. m. central in the Lower Missouri valley, and on the 18th, 7:35 a. m., central at St. Louis. The area now extended east and east-northeast, and on the 19th, 7:35 a. m., was central in Pennsylvania, and on the 20th, 7:35 a. m., was central off the Middle Atlantic coast. The path of this area of high pressure was to the northward of and parallel to the path of low barometer No. VI.

Nos. IV and V.—The three depressions that appear upon the map of September 21st, 7:35 a. m., were separated by an area of high pressure, then central over Lakes Huron and Michigan, which moved rapidly southeastward over Pennsylvania, and on the 23rd, 7:35 a. m., was central in the Middle Atlantic States, off which coast it remained until the 26th, 4:35 p. m., after which it was reinforced by high area No. V, which was then advancing directly southward over the St. Lawrence valley, and which was, on the 28th, still further reinforced, so that on the morning of that day almost the entire country was under a pressure exceeding 30.05, the highest, 30.35, being in Nova Scotia, and the whole acting as a feeder to the cyclones XI and XIII that were advancing from the Caribbean sea northward.

*Areas of Low Pressure in General.*—Of the barometric depressions recorded during September, six have been attended by violent winds, i. e., Nos. II, VI, VII, IX, XI and XIII; the others have been characterized only by local winds, and have soon died away. Four severe storms have pursued their paths off our south and east coasts, and have not encroached upon the land so much as in the September of previous years. The other depressions have originated in the heated air of the Rocky Mountains; and of these No. II was the only one which advanced so far as the Atlantic ocean, where it soon became a severe storm.

*Areas of Low Pressure.*—No. I was central on the 1st in the lower St. Lawrence valley, and on the 2d over the Gulf of St. Lawrence, where it developed into a moderate storm; on the 3d, at 11 p. m., it was central over the northern part of the Gulf, and on the 4th was followed by westerly gales.

No. II.—This depression appears in the Northwest on the 4th, at 11 p. m.; it was, at 7 a. m. of the 5th, central in Illinois, whence it moved very slowly eastward, and was, at 7 a. m. of the 7th, central over the Chesapeake Bay. During the rest of the 7th it apparently moved eastward, and afterwards, during the 8th and 9th, northeastward; at 7 a. m. of the 10th, the centre was apparently east of Nova Scotia. During the 7th, 8th and 9th, heavy northeast gales prevailed along the Middle Atlantic and New England coasts, doing much damage, and was accompanied by high seas at Long Branch, Martha's Vineyard and other places. The schooner Addie Fuller, on the 9th off Hatteras, experienced a wind of 40 miles as measured by her anemometer.

No. III.—On the 7th a slight depression existed in New Mexico, while southeast winds prevailed in Texas. On the 8th this had developed into a trough of low pressure, extending from Texas to Montana, while the area of greatest deviation from the normal pressures for the month lay considerably to the northward. At 11 p. m. of the 8th and 7 a. m. of the 9th this trough is replaced by a well-defined area of low pressure, central in eastern Kansas and Nebraska. This depression now moved slowly eastward, reaching Ohio and Indiana at 7 a. m. of the 10th, and remained nearly stationary in this region until it disappeared at 11 p. m. of the 11th.

No. IV.—This depression was west of Manitoba at 4:35 p. m. of the 9th, and continued in the British Possessions until 11 p. m. of the 11th, where it was succeeded by northwest winds and rising barometer.

No. V.—This depression apparently began as the southern portion of the preceding one, and developed, during the 12th, in western Kansas and Nebraska. It moved northward, and on the 13th, at 4:35 p. m., was central in Manitoba. It now extended slowly eastward, and on the 15th, at 4:35 p. m., had disappeared northeast of Lake Superior.

No. VI.—This severe storm first appeared on our tri-daily maps at 7:35 a. m., of the 16th. There had been a steady fall of pressure at all our Gulf stations from 11 p. m. of the 12th to 11 p. m. of the 15th; the

amount of this fall varied from 0.07 at Punta Rasa to 0.14 at Brownsville. The winds had been steady south-southeast and east, with clear or partly cloudy weather, except in the eastern portions occasional rains. The velocity of the winds had, however, increased from 4:35 to 11 p. m. instead of diminishing, in accordance with the normal diurnal changes, and at 7:35 a. m. of the 16th they had still further increased at Galveston and Indianola, and had backed to the northeast, with threatening and rainy weather. The fall of 0.06 in pressure at these stations, while it remained stationary at Brownsville and New Orleans, was additional evidence to indicate that the centre of the storm was approaching these stations. At this time the area of 29.80, or less, seems to have occupied the western third of the Gulf of Mexico, while the region of lowest pressure was still nearer to the Texas gulf. From 11 p. m. of the 15th to 11 p. m. of the 16th, the barometer was stationary in Louisiana and the East Gulf States; it fell on the Texas coast, but fell and rose again at Brownsville. The central depression apparently moved northward from latitude  $26^{\circ}$  to latitude  $28^{\circ}$ , and thence northeast to latitude  $29^{\circ}$ , and at 11 p. m. of the 17th the lowest pressure was probably 29.50 or .55, and situated 100 miles east southeast of Galveston. The following notes were reported by the Signal Service observer at Galveston: "An unusually high temperature prevailed for several days previous to the cyclone of 1875, and to the present one. On the 15th nothing unusual was noticed, except a faint lunar halo in the evening; later at night light, fleecy cirro-cumulus clouds came up from the south. The morning of the 16th opened with heavy fitful showers from the east, lasting at first but a quarter of a minute, but soon increased to a nearly continuous rain from the northeast. The peculiarities of the clouds were closely watched. At times they consisted of a uniform veil of stratus or nimbus, apparently calm; at other times of low cumulo-stratus-like scud, moving rapidly from the northeast; through rifts in the latter were frequently discernible a higher veil of stratus or cirro-stratus also apparently calm. This upper stratum was occasionally broken in place, disclosing spots of hazy sky. Increasing northeasterly winds and heavy rains continued throughout the day, with slowly but steadily diminishing pressure. The falling barometer would not have been considered worthy of notice but for the northerly winds and peculiar threatening aspect of the clouds. The tide was also rising slowly, and the gulf flecked with breakers and caps. At 7:50 p. m., Washington time, the display of cautionary signals was ordered; but the threatening weather had already been sufficient to warn the mariners, all of whom had made themselves as secure as possible. At 11 p. m., Washington time, the wind had increased to 24 miles; and about 1 a. m. of the 17th, on learning from Indianola that a velocity of 52 miles was prevailing there, the following series of observations was begun:

Date and Hour.	Barometer.	Thermom.	Relative humidity.	Wind.	Velocity.	Weather.	Date and Hour.	Barometer.	Thermom.	Relative humidity.	Wind.	Velocity.	Weather.
Sept. 16, 12:30 p. m.	29.72	78	95	NE	21	Light rain.	Sept. 17, 3:00 p. m.	29.50	72	100	NE	43	Light rain.
17, 12 Mid-n't.	29.70	76	100	NE	19	Light rain.	17, 3:30 p. m.	29.51	72	100	NE	40	Light rain.
17, 12:30 a. m.	29.37	70	100	NE	25	Light rain.	17, 4:00 p. m.	29.50	72	100	NE	44	Light rain.
17, 1:00 a. m.	29.08	70	100	NE	22	Heavy rain.	17, 4:30 p. m.	29.50	73	90	NE	48	Threatening.
17, 1:30 a. m.	29.07	75	100	NE	21	Light rain.	17, 5:00 p. m.	29.53	73	90	NE	48	Light rain.
17, 2:00 a. m.	29.45	70	100	NE	21	Light rain.	17, 5:30 p. m.	29.52	74	90	NE	48	Light rain.
17, 2:30 a. m.	29.44	70	100	NE	21	Light rain.	17, 6:00 p. m.	29.52	74	90	NE	50	Light rain.
17, 3:00 a. m.	29.03	76	100	NE	20	Light rain.	17, 6:30 p. m.	29.55	75	85	NNE	48	Threatening.
17, 3:30 a. m.	29.23	76	100	NE	23	Light rain.	17, 7:00 p. m.	29.57	75	85	NNE	48	Threatening.
17, 4:00 a. m.	29.61	76	100	NE	20	Light rain.	17, 7:30 p. m.	29.40	74	85	NNE	50	Threatening.
17, 4:30 a. m.	29.63	76	100	NE	21	Light rain.	17, 8:00 p. m.	29.42	74	90	NNE	48	Cloudy.
17, 5:00 a. m.	29.61	76	100	NE	24	Light rain.	17, 8:30 p. m.	29.61	74	90	NNE	48	Clearing.
17, 5:30 a. m.	29.60	74	100	NE	24	Light rain.	17, 9:00 p. m.	29.65	74	85	NNE	48	Threatening.
17, 6:00 a. m.	29.61	74	100	NE	24	Light rain.	17, 9:30 p. m.	29.67	73	90	NNE	48	Light rain.
17, 6:30 a. m.	29.62	76	100	NE	24	Light rain.	17, 10:00 p. m.	29.66	73	90	NNE	50	Light rain.
17, 7:00 a. m.	29.60	76	100	NE	21	Light rain.	17, 10:30 p. m.	29.68	73	90	NNE	50	Light rain.
17, 7:30 a. m.	29.62	75	100	NE	25	Heavy rain.	17, 11:00 p. m.	29.68	73	85	NNE	48	Threatening.
17, 8:00 a. m.	29.61	73	100	NE	27	Light rain.	17, 11:30 p. m.	29.64	73	81	N	44	Cloudy.
17, 8:30 a. m.	29.61	73	100	NE	25	Light rain.	17, 12 Mid-n't.	29.60	72	85	N	41	Threatening.
17, 9:00 a. m.	29.61	74	100	NE	30	Light rain.	18, 12:30 a. m.	29.43	71	90	N	46	Threatening.
17, 9:30 a. m.	29.57	73	100	NE	44	Heavy rain.	18, 1:00 a. m.	29.38	71	85	N	39	Cloudy.
17, 10:00 a. m.	29.56	73	100	NE	40	Heavy rain.	18, 1:30 a. m.	29.68	71	80	N	43	Cloudy.
17, 10:30 a. m.	29.54	73	100	NE	47	Light rain.	18, 2:00 a. m.	29.64	71	80	N	44	Cloudy.
17, 11:00 a. m.	29.33	73	100	NE	39	Light rain.	18, 2:30 a. m.	29.49	70	84	N	41	Cloudy.
17, 11:30 a. m.	29.32	72	100	NE	50	Light rain.	18, 3:00 a. m.	29.71	70	84	N	38	Cloudy.
17, 12 noon	29.49	72	100	NE	41	Light rain.	18, 3:30 a. m.	29.71	70	79	N	34	Cloudy.
17, 12:30 p. m.	29.49	71	100	NE	40	Light rain.	18, 4:00 a. m.	29.73	70	79	N	36	Cloudy.
17, 1:00 p. m.	29.48	71	100	NE	33	Light rain.	18, 4:30 a. m.	29.73	70	79	N	37	Cloudy.
17, 1:30 p. m.	29.49	72	100	NE	50	Light rain.	18, 5:00 a. m.	29.75	69	79	N	34	Cloudy.
17, 2:00 p. m.	29.49	72	100	NE	44	Light rain.	18, 5:30 a. m.	29.76	69	79	N	35	Cloudy.
17, 2:30 p. m.	29.48	72	100	NE	40	Light rain.	18, 6:00 a. m.	29.77	69	79	N	34	Cloudy.

It is believed that the anemometer would have registered higher but for the presence of a large building on the north side of this office, which has a tendency to deflect the (northerly) winds upwards and over the instrument. The only evidence of atmospheric electricity observed during the storm, consisted of a single faint glare of light at 2:35 a. m. on the 18th, visible for an instant in the northern portion of the heavens.



The damage done to property in Galveston and the vicinity is estimated at about \$100,000. Total rain-fall during storm, 8.76 inches. Highest velocity, 60 miles, on the 7th, 6:45 p. m. Average velocity of the wind 38.8 miles during 48½ hours. The log of the steamship State of Texas furnishes no additional items.

This storm-centre passed eastward along the Louisiana coast to the mouth of the Mississippi, thence eastward through the Gulf and South Atlantic States, until it was lost to our view on the 21st over the Gulf stream. The observer at Indianola reports as follows: 15th, tide rose 3 feet. 16th, strong wind and very high tide all day; rain showers in the morning and afternoon; many inhabitants left the town at 5 p. m. 17th, north wind all day, maximum 72 miles, lowest pressure 29.62, at 4 a. m.; tide had risen 10 ft. 6 in., and then fell 2 ft. 18th, strong north wind; cloudless day. Cautionary Signals ordered September 16th, 7:50 p. m., whereupon everyone left the city, which was subsequently flooded with the high tide. No great amount of damage reported.

New Orleans reports on the 16th light showers, and on the 17th heavy showers, with increasing winds. Cautionary Signal was displayed during the whole of the 17th, and vessels remained in harbor. On the 18th very heavy rain and wind exceeding 25 miles per hour throughout the day. Lowest pressure, 29.40 in., occurred on the 18th, 7 p. m. Heavy gale prevailed from the 18th, 9 p. m., to 19th, 3 a. m. Maximum wind velocity, northeast, 39 miles, occurred on the 19th.

The observer at Mobile reports signal displayed during the whole of the 17th. Wind exceeded 25 miles per hour, after 4:30 p. m., of 18th, and up to 11:15 a. m., of 19th. The maximum was 35 miles at 9:15 a. m. The barometer was lowest, 29.45, at 7 a. m., of 19th. Very heavy rain fell from 12:30 a. m., of 18th to 8 a. m., of 19th.

The observer at Montgomery, Ala., reports heavy rain and north to east winds throughout the 18th and 19th. On the 18th the upper stratum of clouds moved slowly from the southeast, while the lower stratum of scud moved rapidly from the northeast. The Black Warrior river rose 63 feet. The loss of crops was very heavy. Key West reports high seas and southwest winds on the 19th.

Tybee Island reports the Cautionary Signal ordered up, 7 p. m., of 18th. Very perfect solar halo visible throughout the day. Northeast gale began at 3 a. m., 19th, continuing until 11 p. m., highest velocity 38 miles. On the 20th, light showers all day, with very heavy sea. On the 21st, signal ordered down, but another gale set in, accompanied by intense zig-zag lightning and culminating in a velocity of 60 miles per hour at 4 a. m., of 22d. Severe northeast gales continued during the 23d, 24th, 25th, 26th and 27th. No vessels were able to go out and on the latter date sea captains reported a hurricane outside of harbor. (See No. XI.)

The steamship *Saragossa*, left Savannah on the 20th, for Baltimore, and returning reached Savannah on the 30th. Experienced northeast gales during the entire time, and especially on the 20th and 21st. On the 27th to 29th, off Cape Henry, the northeast winds were of hurricane violence. The gale of the 20th and 21st was related to the storm No. V; the hurricane of the 27th to 29th, accompanied low No. XI.

No. VII.—While the preceding storm was moving eastward through the Gulf States a severe storm (No. VII.) was moving northward toward Nova Scotia, somewhat as shown by the dotted track given on chart No. I. Its nearest approach to the coast was apparently 11 p. m. of 21st. Of its previous history the only report that has as yet come to hand, is the loss of the Brig *Harley John* in lat. 30° 19', long. 56° 45', on Sept. 17th, during a hurricane from E. veering W.

No. VIII.—This depression appeared in Western Dakota at 7:35 a. m. of 21st, where it developed rapidly during the hot portion of the day, and was accompanied by high winds in the Northwest, but very little rain or cloud, it therefore died away after moving slowly southeastward through Minnesota to Wisconsin, which State it reached on the 23rd. This depression appears to have had an earlier origin in the region between Kansas, Nevada and Washington Territory, over all of which the pressure fell during the hottest portion of the 20th. The deviations from normal pressures show that at 11 p. m. of the 20th this depression covered the whole of our Rocky Mountain stations, and extended northwestward into British America. On the 21st, 11 p. m., the greatest depression was in Nebraska, Dakota and Minnesota, and was immediately followed by a rapid rise, coming in from the north, and in consequence of which the depression died out without further development.

No. IX.—The western part of area of low barometer, mentioned in the previous section, remained in the Rocky Mountain region, as a nucleus out of which subsequently developed the present area No. IX. On the 23rd, at 4:35 p. m., this area finally advanced from Colorado northward, and on the 24th the map of isobars places the centre in southwestern Minnesota. The depression disappeared on the 25th.

No. X.—During the 25th the barometer suddenly fell in Montana and Idaho, and the depression thus initiated was on the 26th, 7:35 a. m., probably central in Dakota, although extending southwestward to Colorado. Although accompanied by considerable rain, the area of low pressure rapidly filled up, and on the 27th disappeared over Lake Superior.

No. XI.—This storm having every appearance of a cyclone, first appeared on our tri-daily maps on the 27th, at 4.35 p. m., east of Florida and moving slowly northward. It was preceded by heavy rain and northeast to southeast gales on the North Carolina coast. It was on the 28th, at 7.35 a. m., southeast of Wilmington, where heavy rain was reported, but no wind, owing to its sheltered location. The barometer had for the previous week been highest to the north of Cape Hatteras, and northeast winds increasing to gales, had prevailed along the South Atlantic coast ever since the disappearance of low barometer No. VI. Owing to its slow progress this storm was very severely felt from Cape Lookout to Cape Henry, where steady northeast gales and high seas continued. The U. S. Steamer Frolic reports experiencing a hurricane on the 22nd and 23rd on the routes between Curacoa, Venezuela (latitude  $12^{\circ}$  N, longitude  $69^{\circ}$  W.) and Porto Rico. The storm-centre was probably then moving northwest and must be identical with the present No. XI. On the 24th the observers at Kingston and Santiago de Cuba reported every appearance of a hurricane at a distance to the northeast. On the 21st a cyclone was reported at St. Vincent and Grenada, (about  $8^{\circ}$  of longitude east of Curacoa,) which therefore apparently extends the path of this cyclone back into the Atlantic ocean.

No. XII.—An area of low barometer appears on the 28th, at 11 p. m., in Western Dakota. On the 29th it moved eastward to Minnesota, and on the 30th extended in a long oval from Iowa northeastward. It was accompanied by little or no rain, and its high winds died away as the depression filled up and disappeared.

No. XIII.—This cyclone existed in the Caribbean sea on the 27th, and will be described in the October Review.

*Storms at Sea.*—The following notes have come to hand relative to storms experienced at sea: 2nd, lat.  $40^{\circ} 10'$  N., lon.  $70^{\circ} 42'$  W., heavy SW., squall; 7th, hurricane passed north of St. Thomas; a gale off Kent Island Flats, M.I.; 9th, lat.  $49^{\circ} 34'$  N., lon.  $37^{\circ} 38'$  W., NW., gale; 10th, lat.  $49^{\circ} 50'$  N., lon.  $38^{\circ} 43'$  W., strong gale, NE. to W. by N., high NW. sea; lat.  $47^{\circ} 20'$  N., lon.  $37^{\circ} 21'$  W., strong gale, NNW. to NNE., head sea; lat.  $48^{\circ} 11'$ , lon.  $44^{\circ} 14'$ , NNW. gale; 11th, lat.  $49^{\circ} 34'$  N., lon.  $24^{\circ} 33'$  WNW. gale; 11th, off Rough and Ready, Cal., strong northwest gale; 12th, lat.  $49^{\circ} 18'$  N., lon.  $18^{\circ} 39'$  W., fresh W. gale, heavy squalls and thick rain; lat.  $49^{\circ} 44'$  N., lon.  $6^{\circ} 54'$  W., fresh SW. gale; 13th, lat.  $49^{\circ} 32'$  N., lon.  $39^{\circ} 10'$  W., strong W. gale, very high sea; lat.  $47^{\circ} 25'$  N., lon.  $37^{\circ} 42'$  W., hard gale and high sea; lat.  $49^{\circ} 18'$  N., lon.  $22^{\circ} 19'$  W., fresh NNW. gale; lat.  $50^{\circ} 18'$  N., lon.  $13^{\circ} 28'$  W., fresh SW. gale; Mabow, C. B., gale during night. 14th, lat.  $46^{\circ} 09'$  N., lon.  $46^{\circ} 18'$  W., strong W. gale, very high sea; lat.  $51^{\circ} 24'$  N., lon.  $14^{\circ} 47'$  W., fresh SW. to NW. gales; lat.  $50^{\circ} 06'$  N., lon.  $28^{\circ} 39'$  W., SW. storms, high sea. 14th and 15th, lat.  $44^{\circ}$  N., lon.  $54^{\circ}$  W., gale. 17th, lat.  $49^{\circ} 29'$  N., lon.  $38^{\circ} 12'$  W., strong SW. gale. 16th and 17th, midnight, about lat.  $26^{\circ} 0'$  N., lon.  $64^{\circ} 30'$  W., hurricane. 17th,  $30^{\circ} 19'$  N., lon.  $56^{\circ} 45'$  W., hurricane from E. veering to W., with terrific sea, lasting 24 hours and moderating to SW. 17th, steamship State of Texas, lat.  $27^{\circ} 50'$  N., lon.  $89^{\circ} 56'$  W., fresh SW. gales and heavy seas. 18th, 2 a. m., steamship State of Texas encountered gale 360 miles from Galveston; noon, lat.  $27^{\circ} 53'$  N., lon.  $91^{\circ} 10'$  W., heavy SW. gales and seas; 4 p. m., wind hauled to north. On the 19th, lowest barometer was 29.65 about 160 miles SE. of Galveston. 18th and 19th, about lat.  $26^{\circ} 0'$  N., lon.  $64^{\circ} 30'$  W., hurricane from S. W.; 19th, lat.  $49^{\circ} 09'$  N., lon.  $31^{\circ} 04'$  W., SW. storm; 20th brig Woodcock, at Halifax, N. S., Sept. 23d, from Inagua, reports: 20th, midnight, on northern edge of Gulf Stream, severe E. N. E. gale, veering to N. W., lasting 48 hours; lat.  $33^{\circ}$  N., lon.  $50^{\circ}$  W., heavy S. S. W. gale, lasting 24 hours; 21st, Northwest Shoals, off coast of Massachusetts northerly gale; off Whitehaven, N. S., gale; St. Paul's Island, C. B., perfect hurricane, lasting 15 hours; Straits of Florida, violent gale; 22nd, Barbadoes and St. Vincent, NE. storms and hurricane; Steamer Alhambra, from Charlottetown to Halifax; September 23rd, off Nova Scotia, severe storm, steward washed overboard, boats smashed, also on the 22d, lat.  $40^{\circ} 22'$  N., lon.  $70^{\circ} 52'$  W., fresh NNW gale; lat.  $41^{\circ} 21'$  N., lon.  $66^{\circ} 16'$  W., fresh NNW gale; lat.  $40^{\circ} 20'$  N., lon.  $70^{\circ} 50'$  W., heavy NW gales and sea. 23d, lat.  $43^{\circ} 13'$  N., lon.  $57^{\circ} 08'$  W., heavy W. gale; lat.  $42^{\circ} 15'$  N., lon.  $58^{\circ} 19'$  W., fresh W. to NW. gale; lat.  $49^{\circ} 19'$  N., lon.  $42^{\circ} 08'$  W., heavy SSW. gale. 23d and 24th, lat.  $36^{\circ} 59'$  N., lon.  $74^{\circ} 50'$ , heavy NE. gale. 24th, Mount Hope Bay, R. I., gale; lat.  $46^{\circ} 48'$  N., lon.  $39^{\circ} 49'$  W., fresh E. gale. 25th, lat.  $45^{\circ} 38'$  N., lon.  $41^{\circ} 56'$  W., severe N. gale, lasting 27 hours; lat.  $49^{\circ}$  N., lon.  $17^{\circ}$  W., heavy gale. 26th, lat.  $45^{\circ} 36'$  N., lon.  $50^{\circ} 35'$  W., fresh NE. gale. 28th, off Hog Island, heavy ESE. gale. 29th, off Cape Hatteras, cyclone from NE.

## TEMPERATURE OF THE AIR.

*In General.*—The general distribution of the temperature of the air is shown by the isotherms on chart No. II. The table of comparative temperatures, in the left hand corner of same chart, shows the temperature of the month to have been higher than usual over the whole country, excepting in the mountainous region of Utah, Colorado and New Mexico. The excess is greatest in the Northwest and Upper Lake region; somewhat less over the Lower Lakes and New England, and still less along the Middle and South Atlantic States, while in the Gulf States, Tennessee and Ohio valley, it is only about half a degree above the normal; as is also the case on the Pacific coast.



*Monthly Mean Temperatures at Special Points* have been as follows: Mt. Washington, 42° 4', Pike's Peak, 30° 9'.

*Maximum and Minimum Temperatures.*—Maximum temperature, at Signal Service stations, above 95°, are reported as follows: 96° at Savannah, Jacksonville, Vicksburg, Indianola, Boerne, Castroville; 97° at Montgomery, Salinas City, Cal.; 98° at Shreveport, Fort Sill, Sacramento; 99° Denison, Fort Griffin; 100° Brackettville, Corsicana, San Antonio, Campo; 101° Cambridge, Visalia; 102° Eagle Pass; 103° Laredo; 104° Phoenix, Uvalde; 106° Red Bluff; 107° Maricopa Wells; 108° Fresno, Wickenburg; 112° Fort Yuma. From stations other than those of the Signal Service, *maximum temperatures* have also been reported as follows: 96° Ft. Haves, Kan. Hennepin, Ill.; 98° Clarksville, Tex.; 99° Baton Rouge, La.; Ft. Richardson, Tex., Camp Sheridan, Neb. 100°, Ft. McPherson, Neb. 101°, Ft. McKavett, Tex. 102° Ft. Rice, Dak.; Ft. Griffin, Tex.; Ft. Clark, Tex.

*Minimum temperatures* below 35°: 34° Breckenridge, Minn., Umatilla; 33° Bismarck, and Lower Brule Agency, Dak., Hayes' City, Kan.; 32° Winnemucca, Neb., Woodstock, Vt.; 30° Ft. Abercrombie, Dak., Pembina; 29° Ft. Randall, Dak., Orono, Me.; 28° Nile, N. Y.; 27° Cheyenne, Wv., Sydney B'ks, Neb.; 26° Summit, Col.; 25° Neillsville, Wis.; 23° Ft. Pembina, Dak.; 21° Coalville, Utah; 20° Mt. Washington, N. H.; 11° Pike's Peak, Col.

The maximum temperatures of the month may be divided into three periods, the first of which occurred from the 1st to 3d in the West Gulf, South and Middle Atlantic States; the second from the 10th to 16th gradually extending from Colorado, Nebraska and Minnesota over the Mississippi valley as far south as Alabama, and thence over the Lake region, New York and New England; and the third on the 30th extending from Lakes Michigan and Huron southward to the Ohio valley.

The minimum temperatures occurred, almost without exception, from the 17th to the 23d, attending the advance of area of high pressure No. III, first from Utah to Iowa and northward, gradually extending thence to the Atlantic coast.

*Ranges of Temperature.*—The large monthly or diurnal ranges have been respectively as follows: Bismarck, monthly, 49°, diurnal 46°; Pembina, 59° and 47°; Breckenridge, 58° and 44°; Winnemucca, 57° and 50°; Umatilla, 61° and 39°; Campo, 69° and 56°; Fort Griffin, 49° and 44°; Cheyenne, 56° and 43°; North Platte, 55° and 45°; Denver, 55° and 45°; Visalia, 55° and 42°; Red Bluff, 54° and 36°; Marquette, 52° and 35°; St. Paul, 52° and 32°; Yankton, 51° and 42°. The least monthly and diurnal ranges have been, respectively, as follows: Cape Hatteras, monthly, 20°, diurnal 11°; St. Marks, 27° and 22°; New Orleans, 29° and 15°; Charleston, 29° and 17°; Jacksonville, 29° and 27°; Punta Rasa, 20° and 17°; Key West, 22° and 13°; Cape Henry, 22° and 1°.

*Frosts*, were experienced as follows. —From the 1st, to the 4th, in Iowa, Wis., Ill., Ind. Mich., Ohio., N. Y., and on Mount Washington; on the 5th and 6th, near Lake Superior; on the 7th and 8th on Mount Washington and in northern Maine; on the 8th and 9th, Utah and Col; from the 17th to 23rd, the first general extensive frost of the season was experienced, being felt first in Utah and Col., and extending thence eastward over the entire country north of the 37th degree of latitude, to the Middle Atlantic and New England coast. Slight damage was reported to vegetation in Col., Dak., Ind., Iowa, Mass. Wis.

*Ice*—was reported on the 1st and 2nd at Detroit; from the 8th to the 10th at Coalville, Utah; 17th, Virginia City, one-eighth of an inch thick; on the 18th, one-sixteenth of an inch at Cresco, Iowa, and Embarrass, Wis.; on the 22nd, ice at Strafford, Vt.

## PRECIPITATION.

*In General.*—The general distribution of rain for the month is shown on chart No. III. The table in the lower left-hand corner gives the average precipitation in the various districts. This table shows a large excess in the Gulf, South and Middle Atlantic coast States, and in Tennessee and Minnesota, and deficiencies from New England westward over the Lake region and Ohio valley to the Upper Mississippi and Missouri valleys. This is almost the reverse of the report for August, and is due mostly to the heavy rain-falls attending the storms Nos. II, VI and XI, shown on chart No. I. As was the case in August, considerably over the average amount has also fallen this month in Oregon, while in California no rain has been reported.

*Special Heavy Rains.*—The following are the most notable cases of heavy rains that have been reported: 1st—Wilmington, N. C., (1st and 2nd,) 5.02 inches; Jacksonville, Fla., 2.00 in.; Anna, Ill., 2.62 in.; Brownsville, Mo., 2.25. 2nd—Cheyenne, Wv. Ter., 1.07 in.; Melissa, Tex., (2nd to 4th,) 3.00 in.; Coleman City, Tex., 2.45 in.; Concho, Tex., 1.34 in. 3rd—Shreveport, La., (3rd, 4th and 5th,) 8.59 in.; 6 inches in 8 hours on the 4th; Fort Griffin, (3rd and 4th,) 2.51 in.; Cambridge, Tex., (3rd and 4th,) 2.12 in. 4th—Fayette, Miss., 2.10 in.; Coleman City, Tex., Miss., 1.79 in.; Stockton, Tex., 1.94 in.; Concho, Tex., (4th and 5th,) 2.02 in. 5th—Pilot Point, Tex., 3.87 in.; Boerne, Tex., 1.84 in.; Coleman City, Tex., 2.16 in. 6th—Galveston,

Tex., 4.83 in.; Indianola, Tex., 1.62 in.; Green Spring, Ala., 2.08 in.; Milford, Del., (6th to 8th,) 5.70 in.; Dover, Del., (6th to 8th,) 3.80 in.; Vineland, N. J., (6th to 8th,) 3.71 in.; Reading, Penn., (6th to 8th,) 3.34 in. 7th—Atlantic City, N. J., (7th and 8th,) 2.00 in.; Norfolk, Va., 2.24 in.; Sandy Hook, N. J., 1.63 in.; Cape May, N. J., (7th and 8th,) 4.71 in.; Barnegat, N. J., 1.74 in.; Cape Lookout, N. C., 1.87 in. 8th—Cambridge, Tex., 1.01 in.; North Platte, Neb., 2.52 in.; Mt. Ida, Ark., (8th and 9th,) 4.00 in.; Fort Wayne, Ind., (8th and 9th,) 3.50 in.; Norfolk, Neb., (8th and 9th,) 1.96 in.; Nile, N. Y., 1.70 in.; Accotink, Va., 2.10 in. 9th—Leavenworth, Kan., 1.24 in.; Green Spring, Ala., (9th and 10th,) 2.23 in.; Quitman, Ga., 2.02 in.; Kansas City, Mo., 2.28 in.; St. Joseph, Mo., 4.80 in.; Lexington, Mo., 1.80 in. 10th—Knoxville, Tenn., 2.27 in.; Savannah, Ga., (10th–11th,) 2.00 in.; Baton Rouge, La., 4.85 in. 11th—Wilmington, N. C., 2.00 in.; Brackettville, Tex., 1.42 in. 12th—Wilmington, N. C., 3.05 in.; Accotink, Va., 2.50 in. 13th—Charleston, S. C., 3.00 in.; 2.00 inches in 30 minutes; Keokuk, Iowa, 1.58 in. 14th—Savannah, Ga., 2.21 in.; Fort Sill, Ind. Ter., 1.19 in.; Fort Snelling, Minn., 1.74 in. 15th—Norfolk, Va., 2.15 inches in 3 hours; San Antonio, Tex., 1.76 in. 16th—Galveston, Tex., (16th and 17th,) 8.70 in. 17th—Knoxville, Tenn., 1.81 in.; Nashville, Tenn., 2.93 in.; Fort Sill, Ind. Ter., 2.08 in.; Baton Rouge, La., (17th, 18th and 19th,) 12.45 in.; S. Orange, N. J., 1.68 in.; Brookhaven, Miss., (17th to 20th,) 7.30 inches in 56 hours. 18th—Mobile, Ala., (18th and 19th,) 8.07 in.; 6.75 in 10 hours; New Orleans, La., (18th and 19th,) 8.40 in.; Carlowville, Ala., (18th, 19th and 20th,) 10.42 in.; Green Spring, Ala., (18th to 20th,) 8.20 in.; Fayette, Miss., (18th and 19th,) 6.20 in. 19th—St. Marks, Fla., 2.26 in. 20th—Tybee Island, Ga., 2.61 in.; Cape Hatteras, N. C., 3.10 in.; Cape Henry, Va., 2.31 in.; Kittyhawk, N. C., 2.65 in. 23rd—Tybee Island, Ga., 2.20 in. 25th—Smithville, N. C., 2.33 in.; North Platte, Neb., 1.93 in. 26th—Peoria, Ill., 2.01 in. 27th—Wilmington, N. C., 3.98 in.; Smithville, N. C., (27th and 28th,) 3.55 in.; Greenville, N. C., (27th to 29th,) 8.30 in.; Chattanooga, Tenn., 2.75 in. 28th—Norfolk, Va., 2.07 in.; Wilmington, N. C., 2.83 in.; Cape Hatteras, N. C., (28th and 29th,) 8.13 in.; Weldon, N. C., 2.06 in.; Capeville, Va., 2.00 in.; Cape Lookout, N. C., (27th, 28th and 29th,) 8.96; Cape Henry, Va., (28th and 29th,) 3.54 in.; Kittyhawk, N. C., (28th and 29th,) 7.25 in.

*Small Monthly Rain-falls.*—The following stations report small monthly rain falls: San Francisco, Red Bluff, Sacramento, Visalia, Fresno, Salinas City, Los Angeles, San Diego and Campo, in California; Winnemucca, in Nevada; and Yuma, Arizona, report no rain-fall; Umatilla, Or., 0.59 in.; Denver, Col., 0.38 in.; Bismarck, Dak., 0.11 in.; Dubuque, Iowa, 0.67 in.; Port Huron, Mich., 0.28 in.; Port Stanley, Port Dover and Toronto, Can., respectively, 0.58, 0.98 and 0.42 in.; throughout Massachusetts and Rhode Island the rain-fall averaged only about half an inch; and in Texas, Brownsville reports 0.69; Rio Grande, 0.10; Laredo, 0.59; Castroville, 0.02; and Mason, 0.29.

*Large Monthly Rain-falls.*—Monthly rain-falls of seven inches or more, are reported as follows: Galveston and Coleman City, Tex., respectively, 13.85 and 7.08 inches; Shreveport, Baton Rouge and New Orleans, La., respectively, 9.93, 18.42 and 13.21 in.; Fayette, Miss., 11.20 in.; Green Spring, Carlowville and Mobile, Ala., respectively, 14.11, 12.43 and 12.62 in.; Mayport, Fla., 8.30 in.; Savannah and Thatcher's Island, Ga., respectively, 8.92 and 11.24 in.; in North Carolina, Wilmington reports 20.10 in.; Smithville, 11.9 in.; Cape Lookout, 16.32 in.; Cape Hatteras, 15.41 in.; Kittyhawk, 13.39 in.; Goldsboro', 16.70 in.; Weldon, 8.08; and Greenville, 16.46 in., Norfolk, Cape Henry, Fort Monroe and Hampton, Va., respectively, 11.90, 10.04, 8.14 and 7.53 in.; Cape May, N. J., 7.22 in.

*Droughts.*—Extensive droughts have prevailed during the month over New England and eastern New York, Indiana, Ohio, southern portions of Michigan, Wisconsin, eastern Iowa and northern portion of Illinois, and numerous reports of dry springs and injury to vegetation have been received from those districts.

*Floods.*—Destructive floods attended the storm No. VI, on chart No. I, at Indianola from the 14th to the 17th; at Galveston on the 17th and 18th; at New Orleans on the 18th; and the 19th and 20th in the valleys of the Black Warrior and Alabama rivers, Alabama. In the last-named districts the crops of cotton, corn and fodder were entirely swept away. It is estimated that 30,000 bales of cotton were destroyed.

*Hail.*—Hail has been reported as follows: 1st, Pike's Peak, Col. 2nd, Adam's, N. Y.; Pike's Peak, Col. 4th, Lower Brule Agency, Dak.; Fort Union, N. Mex.; Pike's Peak, Col. 5th, four miles northeast of Fort Union, N. M., (severe.) 14th, Portland, Or. 15th, Fort Pembina, Dak., and Virginia City, Mont. 19th, Wytheville, Va.; Alpena, Mich. 21st, Gardiner, Me.; Somerset, Mass.; Fort Wingate, N. Mex. 23rd, Camp Brown, Wyo. 25th, Emerson and North Platte, Neb. 27th, Breckenridge, Minn. 30th, Marquette, Mich.

*Snow.*—On the 7th, 12th and 27th snow-squalls were reported at Virginia City, Mont., and on the 12th at Austin, Eureka and other places in Nevada. At Summit, Col., 11½ inches of snow fell in six days, and snow was also reported on Pike's Peak on seven days, but had all melted before the end of month. On the 14th snow fell on Baldy Mountain, N. M.; on the 3d the first snow-fall of the season occurred on Mt. Washington, N. H., and on the 21st a furious snow-storm occurred there.



**Rainy Days.**—The number of days on which rain has fallen, as recorded by Signal Service observers, ranges as follows: New England, 3 to 12; Middle Atlantic States, 4 to 19; South Atlantic States, 5 to 19; East Gulf States, 11 to 15; West Gulf States, 6 to 14; Tennessee and Ohio valley, 7 to 13; Missouri valley, 5 to 8; Upper Mississippi valley, 6 to 11; Upper Lake region, 8 to 14; Lower Lake region, 8 to 13; Rocky Mountain stations, 0 to 13; California, 0; Oregon, 11.

**Cloudy Days.**—The number of cloudy days reported during the month by Voluntary Observers and Army Surgeons, ranges about as follows: New England, 0 to 7; Middle Atlantic States, 0 to 16; South Atlantic States, 4 to 16; East Gulf States, 7 to 13; West Gulf States, 3 to 8; Tennessee and Ohio valley, 1 to 9; Lower Missouri valley, 0 to 7; Upper Mississippi valley, 1 to 8; Lake region, 0 to 12; Rocky Mountain stations, 0 to 5; California, 0 to 4.

## RELATIVE HUMIDITY.

The average relative humidity for the month ranges about as follows: New England, 67 to 81; Middle Atlantic States, 67 to 81; South Atlantic States, 71 to 82; East Gulf States, 71 to 82; West Gulf States, 65 to 76; Tennessee and Ohio valley, 66 to 78; Lower Missouri valley, 65 to 69; Upper Mississippi valley, 65 to 67; Upper Lakes, 61 to 74; Lower Lakes, 68 to 75; California, 43 to 71; Oregon, 48 to 78.

High stations not corrected for elevation report as follows: Pike's Peak, 61; Mt. Washington, 72; North Platte, 53; Cheyenne, 42; Denver, 36; Santa Fe, 34; Salt Lake City, 31.

## WINDS.

**In General.**—The prevailing winds at Signal Service stations are shown by arrows on Chart No. II, from which it will be seen that the winds were northeasterly from Virginia southeastward to Florida; east along the immediate east Gulf coast; south and southeast from Texas northward to Minnesota; south or southwest in the Lake region; southwest along the New England coast, and from southwest to southeast in the Middle Atlantic States.

**Total Movements.**—The largest total movements have been as follows: Stockton, Tex., 15,789 miles; Pike's Peak, 13,471 miles; Cape Lookout, 11,648; Kittyhawk, 11,064; Cape Hatteras, 9,625; Cape Henry, 9,542; Tybee Island, 9,513; North Platte, 9,510; Dodge City, 9,064. The smallest movements have been as follows: Salt Lake City, 1,534; Lynchburg, 1,810; Visalia, 1,879; Nashville, 1,950; Indianapolis, 2,752; Cincinnati, 2,858; Knoxville, 2,971; Portland, Or., 2,852.

**The highest velocities**, in miles per hour, have been as follows: 3rd, Mt. Washington, NW., 60; 7th, North Platte, W., 72, and Barnegat, E., 60; 8th, Dodge City, NW., 50; 14th, La Crosse, NW., 60; 16th and 21st, Pike's Peak, W., 56; 17th, Galveston, NE., 60, and Indianola, S., 72; 18th, New Orleans, NE., 39; 19th, Mobile, SE., 35; 21st, Mt. Washington, NW., 72; 22nd, Bismarck, N., 72, and Tybee Island, NE., 60; 27th, Cape Lookout, SE., 78; 28th, Cape Hatteras, NE., 48, and Cape Lookout, S., 80; 29th, Cape Lookout, NE., 86; 30th, Bismarck, —, 72.

**Local storms, tornadoes, &c.**, have been reported as follows, (unless specially noted, it is understood that the following list of high winds includes only local storms, and not such gales as prevailed simultaneously over a large region): 1st, Maysville, Ky., a tornado of terrific violence and short duration, unroofing buildings and damaging shipping to a considerable extent. 2nd, Coleman City, Texas, violent storm, with heavy rain. 3rd, Yuma, Arz., terrific sand-storm, during which a large whirlwind passed up north side of Colorado river. 5th, heavy rain and wind-storm at New Orleans, doing considerable damage to shipping on north side of river. 11th, Coleman City, Texas, sand-storm, estimated velocity of wind 40 miles per hour. 12th, Colorado Desert, Cal., during a heavy thunder-storm between Pilot Knob and Cateus a water-spout burst, destroying four hundred feet of railroad track. 14th, La Crosse, Wis., northwest gale, doing damage to buildings.

## VERIFICATIONS.

**Indications.**—The detailed comparison of the tri-daily weather indications, with the telegraphic reports for the succeeding twenty-four hours, shows a general percentage of omissions of 0.4 per cent., and of verifications of 85.5 per cent. The percentages of verifications for the four elements have been: weather, 88.6; wind, 83.7; temperature, 88.5; barometer, 81.0. The percentages of verifications by geographical districts have been: New England, 83.0; Middle Atlantic States, 85.5; South Atlantic States, 86.7; East Gulf States, 84.2; West Gulf States, 87.2; Lower Lake region, 86.2; Upper Lake region, 85.9; Tennessee and Ohio valley, 83.1; Upper Mississippi valley, 88.0; Lower Missouri valley, 85.0. Of the 3,588 predictions that have been made, 116, or 3.1 per cent., are considered to have entirely failed; 109, or 3.0 per cent., were one-fourth verified; 422, or 11.8 per cent., were half-verified; 444, or 12.4 per cent., were three-fourths verified; 2,497, or 69.6 per cent., were fully verified, so far as can be judged from our weather maps.



*Cautionary Signals.*—During the past month 163 Cautionary Signals have been displayed at 47 stations on the Gulf and Atlantic coasts, and on the Lakes, of which 94, or 58 per cent., were reported verified within 100 miles of the station. Thirty-one cases of high winds, where no signals were displayed, have also been reported from these stations.

## NAVIGATION.

*Stages of water in rivers.*—In the table, on Chart No. III, are given the highest and lowest readings on the river gauges for the month, from which it will be seen that the central Mississippi fell from the middle of the month steadily to the end, the fall at St. Louis and Keokuk being about four feet; similarly the Missouri also fell throughout the month by about one foot at Yankton, and two feet six inches at Leavenworth. The water has been at some stations remarkably low.

*Low Water,* detrimental to navigation, has been reported as follows: *Mississippi*, 16th, Keokuk, Iowa, river low, delaying light draft boats; 22d, river still falling, canal closed; reports of low water at St. Louis and Alton. 30th, Shreveport, steady fall in river during month, navigation obstructed; reports of low water also come in from the Ohio at Evansville and Louisville.

*Special Phenomena.*—On the 21st, just before day-break, a wave, two feet high, similar to the earthquake waves in the Atlantic and Pacific oceans, swept across Lake St. Clair, from west to east. On the 24th, at Marquette, Mich., between 10 a. m. and 3 p. m., the wind being light from the SE., the water in the Lake fell fifteen inches.

## TEMPERATURE OF WATER.

*In General.*—The temperatures of water, as observed in rivers and harbors, are shown in the table on Chart No. III.

*Maximum and Minimum Temperatures.*—The highest maxima have been 90° at Galveston, 88° at Wilmington, 86° at Mobile and Augusta, 85° at Montgomery, 84° at Charleston and Savannah, and lowest minima have been 45° at Duluth, 46° at Eastport, 55° at Portland, Me., 56° at Marquette, 58° at Alpena and Escanaba, 59° at San Francisco.

*Ranges of Temperature.*—The least ranges have been: 2° at San Francisco; 3°, Eastport; 4°, Marquette; 6°, Portland, Me., Wood's Holl, New London, Buffalo and La Crosse; and largest ranges have been 20°, Galveston and Wilmington; 21°, Duluth.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms* were reported at stations in the respective States as follows: 1st, Ala., Nev., Conn., Ill., Kan., Miss., Mo., N. J., N. C., Pa., Tex., Va., W. Va., Fla., Tenn., Ga., Ind. Ter. 2nd, Col., Wy., Fla., Mich., Miss., N. Y., Tex., N. C. 3rd, Dak., Col., Kan., Me., N. Y., Tex., La., Ariz. 4th, Dak., Col., Mich., Miss., Tex., Wis. 5th, N. Y., Col., Iowa, Me., Miss., Neb., Tex., Vt. 6th, Ga., Iowa, Me., Miss., N. Y., N. C., Tex., Wash. Ter. 7th, Dak., Wy., Fla., Iowa, Miss., S. C., N. C., Fla., Ga., Minn. 8th, Col., Dak., Kan., Mo., Neb., N. J., Tex., Ind. Ter. Ga. 9th, Ga., Ill., Miss., Mo., Tex., Fla. 10th, Fla., Ga., Ind., Mich., Miss., Ohio, Tenn. 11th, Cal., Fla., Ga., N. C., Pa., Tex., W. Va., Ariz. 12th, Dak., Wy., Md., Miss., Mo., N. J., N. C., Ohio, Pa., Tex., Utah, Va., W. Va., N. Y., La., D. C. 13th, Dak., Wy., Fla., Ill., Kan., Md., Miss., N. J., N. Y., N. C., Ohio, Tex., Va., W. Va., S. C., Ga., D. C., Minn. 14th, Dak., Ill., Iowa, Kan., Md., Miss., Mo., Neb., N. C., W. Va., Ga., Wis., Ind. Ter., Tex. 15th, Dak., Va., Ill., Iowa, Ky., Md., Miss., N. C., Pa., Tex., S. C., Ga., Ind. 16th, Ill., Ind., Me., Mass., N. Y., Tenn., Va., Ky. 17th, N. Y., Va., Ind., Me., Md., Miss., N. J., Ohio, Pa., Tex., Vt., W. Va., Ind. Ter., D. C. 18th, Iowa. 19th, Fla. 20th, N. Y., Ga., S. C., N. C., Fla. 21st, Col., Me., Mass., N. Y., Ga. 22nd, Dak., Ga., Me. 23rd, Dak., Neb., Col., Ga. 24th, Neb., Iowa, Wis., Mich., Dak., N. Mex. 25th, Tex., Ill., Iowa, Kan., Mich., Mo., Wis., Ind. Ter., Neb. 26th, Dak., Iowa, N. Y., Me., Mich., Neb., Ohio, Pa., Vt., Wis., Mo., Ga., Tex. 27th, Conn., N. Y., Wis., Tenn., Mich., Ala. 28th, N. Y., Pa., Vt., N. C., Mich. 29th, Mich., Wis. 30th, Iowa, Neb., Wis.

*Distant Thunder and Lightning* was reported from stations, in the respective states, as follows: 1st, Ga., Kan., Md., Mass., N. Y., Pa., S. C., Ind. Ter., La., Tex. 2nd, Md., Mass., N. C., Va., Ga., La., Tex. 3rd, Tex. 4th, Iowa, Neb., Wis., Dak., N. Mex., Minn. 5th, Me., Mass., Ga., Tex. 6th, Ga., Mich., N. C., La., Dak. 7th, Neb., S. C., Pa., Ga. 8th, Md., Tex. 9th, Tenn., La., Me., Tex. 10th, N. C., Ohio, Tex., Ind. 11th, N. C., Ohio, S. C., Ga., Ind. Ter., Tex. 12th, Md., N. C., S. C., Ga., Iowa, Tex. 13th, Iowa, Neb., Ohio, Ga., Dak., Minn. 14th, Md., Va., Iowa, Ind. Ter., Dak. 15th, Tenn., Wis., Ga. 16th, Ill., Ind., Kan., Mo., Tenn., Ohio, Iowa, Ind. Ter. 17th, Va., Ohio. 19th, Ga. 20th, Utah. 23rd, Fla. 24th, Wis., Wyo., Neb. 25th, Ill., Iowa, Kan., N. Y., Wis., Vt. 26th, Ill., Iowa, Kan., Wis. 27th, Mo., Ga. 28th, Md. 30th, Ill., Mich., Wis.

*Auroras* were observed as follows: 1st, Ft. Pembina, Dak.; 5th, Louisville, Ky.; 7th, (?) Cambridge, Mass.; 15th, Escanaba, Mich., Clarksville, Tenn., Gardiner, Me., Rowe, Mass.; 17th, Waltham, Mass., Burlington, Vt.; 18th, Rocky Run and Wautoma, Wis., Portland and Bangor, (very fine) Gardiner and Mechanics' Falls, Me., Plattsburg, N. Y., Contoocookville and Auburn, N. H., Woodstock, Vt., Boston, Mass.; 19th, Cambridge, Mass.; 21st, Wautoma, Wis.; 30th, Starkey, N. Y.

*Ground Currents*.—Disturbances on lines of telegraph have been reported as follows: 4th, Pike's Peak, Col., and Concho, Texas, (during thunder-storms.)

## OPTICAL PHENOMENA.

*Solar Halos* were observed as follows: 1st, Tex., Ky., Ind. Ter., Ga. 2d, Me., Neb., La., N. Mex. 3d, Ga., Iowa, Ky. 4th, Iowa, Ohio, Ky., La., Ill. 5th, Conn., Mass., N. H., N. Y., Ga., D. C. 6th, Ga. 8th, Ill. 10th, Conn., Mass., N. H., N. Y., R. I., Me. 11th, Conn., Miss., N. H., N. Y., Ga., Mo., La., Fla. 12th, Me., R. I., Conn. 13th, Ill., Me., Conn. 14th, Ill., Ohio, Texas. 16th, Iowa, Wis., La., Tex. 17th, N. Y., La. 18th, Fla., Va., Ga., Ky. 19th, Conn., Ind., Iowa, Md., N. Y., Ohio, Va., Wis., Ky., N. J., Ill. 20th, Ky., Ohio, Mo. 22d, N. C. 23d, Neb., Ohio, Fla., Kan. 24th, Mo. 25th, Iowa. 26th, Conn., N. J., N. Y., Ohio, Va., R. I., Ky. 27th, Conn., Mass., Ohio, Vt., R. I., D. C., Fla. 28th, N. Y. 29th, Fla., Ga.

*Lunar H'los*.—12th, Fla.; 13th, Conn., Tex.; 14th, Ill., Mo., Wis., Me.; 15th, Miss., N. J., Mo., La., Tex.; 16th, Ohio, Minn., Tenn., La., Tex., Ala.; 17th, Fla., N. C., Va., Ga., Mass., Mo., Ala., Minn.; 18th, Fla., Ind., Ky., Md., N. J., Pa., Va., W. Va., Conn., Mo., Wis., Minn., N. C.; 19th, Conn., Ill., Ind., Iowa, Md., Mass., N. J., N. Y., Ohio, Pa., Va., R. I., W. Va., Ky., Mo., Minn., La.; 20th, Fla., Mass., R. I., N. C., Mo., Wis., Minn.; 21st, Md., N. J., Conn., Mo., Wis., Cal.; 22nd, Md., Mich., S. C., Mo., Minn., N. C.; 23rd, Mo., Conn., Minn., Cal.; 24th, Minn., Ohio, Ala., N. C.; 25th, Ind., Me., Md., Ohio, Tenn., W. Va., Mich., Ala., Minn., Idaho, Kan.; 26th, Del., Ind., Iowa, Md., Ohio, Pa., Utah, N. Y., W. Va., Me., Tex.; 27th, Iowa, W. Va., Va., Mo., N. J., D. C.; 28th, Fla., N. J., Ohio.

*Mirage*.—Tybee Island, Ga., 2nd, 3rd and 6th. New London, Conn., 5th, 9th, 10th, 19th, 22nd, 23rd and 30th.

## MISCELLANEOUS PHENOMENA.

**BIRDS.**—*Ducks*: 3d. Large flocks reported on Lower Fraser river, British Columbia, fully six weeks earlier than usual; Fort Pembina, Dak., S., 22nd; Clear Creek, Neb., and Portland, Or., S., 15th; St. Paul, Minn., S., 24th. *Wild geese*: Fort Randall, Dak., flying S., 18th, 20th; Fort Pembina, Dak., S., 24th; Sedgewick, Kan., SW., 28th; New Bedford, Mass., S., 26th; Fall River, Mass., SW., 23rd; Corning, Mo., S., 15th and 26th to 30th, moving in various directions from river to corn-fields; Clear Creek, Neb., S., 19th; Geneva, Neb., S., 11th; West Charlotte, Vt., S., 26th; Davenport, Iowa, S., 16th; Visalia, Cal., N., 16th; Bismarck, Dak., S., 14th. *Swallows*, Fall River, Mass., had departed, 22nd; Contoocookville, N. H., had left on the 2nd; Auburn, N. H., 10th, and Starkey, N. Y., 16th. *Martins*, Melissa, Tex., had all disappeared 12th. *Blackbirds* and *Robins*, congregating before migration on the 18th, at Wappinger's Falls, N. Y. *Wild Pigeons*, at Jacksonsburg, Ohio, S., 20th. *Whip poor-wills*, Fayette, Miss., flying S., 2nd, 15th and 18th; Auburn, N. H., had departed, 12th. *Pelicans*, Corning, Mo., appeared in large numbers 25th. *Blue-jays*, 24th, Sedgewick, Kan., flying S. *Black birds*, Clear Creek, Neb., flying S., 8th. *Cat birds*, Oregon, Mo., 7th. *Yellow birds*, Oregon, Mo., 20th. *Cranes*, Genoa, Neb., S., 17th; Wappinger's Falls, N. Y., were seen, 2nd; Oregon, Mo., S., 6th. *Heron*, Wappinger's Falls, N. Y., E., 27th. *Plover, quail and partridge*, Wappinger's Falls, N. Y., were seen 2nd to 8th. *Blue birds*, Wappinger's Falls, N. Y., seen flying S. 16th.

**INSECTS.**—*Gasshoppers*, Tabor, Iowa, none this fall; 11th, becoming numerous at Starkey, N. Y. *Colorado beetles*, Mendon, Mass., abundant during month.

**BOTANICAL.**—*Maize*, (Indian Corn).—5th, Guttenberg; large crop now ripe; 30th, Oregon, Mo., maturing rapidly. *Buckwheat*, ripe at Wappinger's Falls, N. Y., 18th. *Cotton*.—Leaves being eaten by worms at Melissa, Texas, 22nd; Clarksville, Texas, reports worms doing only little damage during early part of month. *Grass*—30th, Oregon, Mo., immense crop of prairie grass hay; great quantities of fodder. *Raspberries*, ripe at West Charlotte, Vt., 22nd.

*Polar Bands*.—Gardiner, Me., 2d, 20th and 23d. Tybee Island, Ga., 3d and 29th. Guttenberg, Iowa, 4th and 6th. Plattsburgh, Neb., 7th. Wytheville, Va., 9th and 18th. Brookhaven, Miss., 10th. Freehold, N. J., 13th and 26th. Milwaukee, Wis., 14th. Auburn, N. H., 16th. Louisville and Danville, Ky., and Vineland, N. J., 19th. Woodstock, Vt., 20th.

*Sunsets*.—The characteristics of the sky, as indicative of approaching fair or foul weather, have been observed daily at sunset at all regular Signal Service stations. Reports from 105 stations show 76 blank or doubtful cases, and that out of the remaining 3,074 cases, 2,551, or 83.0 per cent., were followed by the expected weather.

**Forest Fires.**—*Smoke* was reported as follows: Morgantown, W. Va., 21st; Detroit, Mich., 28th; Rochester, 7th, 27th and 28th; Buffalo, N. Y., 21st; Pittsburgh, Pa., 20th; Cheyenne, W. T., 12th; Sacramento, Cal., 4th, 8th, 9th, 18th, 20th, 22nd, 24th, 26th, 28th and 29th; Milwaukee, Wis., 13th; Springfield, Mass., 24th and 25th; North Platte, Neb., 24th. *Forest fires* of importance were reported: Denver, Col., heavy fires in mountains, 27th and 28th; Visalia, Cal., heavy fires in mountains, 17th, 18th and 20th, (fine whirlwind of cloud and smoke observed for 45 minutes.) *Prairie fires*: Bracketsville, 1st, 2nd, 3rd, 4th and 5th; Bismarck, Dak., 10th, 12th and 22nd to 29th; at several stations in Dakota, 2nd, 6th, 7th, 8th, 11th, 13th, 21st, 27th, 28th, 29th and 30th; Dodge City, Kan., 16th, 17th, 20th, 21st, 22nd, 23rd and 24th.

**Meteors** were observed: 1st, Dubuque, Iowa. 3rd, Visalia, Cal.; Boise City, Idaho. 5th, Savannah, Ga. 7th, Boise City, Idaho. 8th, Savannah, Ga. 10th, Dubuque, Iowa; Mt. Washington, N. H. 13th, Yankton, Dak. 15th, Savannah, Ga. 16th, Bismarck, Dak. 19th, Indianapolis, Ind. 23rd, Burlington, Vt. 26th, Stockton, Texas. 27th, Savannah, Ga. 28th, Bangor, Me. 29th, Eagle Pass, Tex., 7:20 p. m., in the N. altitude 30°; Visalia, Cal., 9:05 p. m., 30° N. of zenith. 30th, Yankton, Dak.; Davenport, Iowa.

**Zodiacal Light** was observed at Monticello, Iowa, 1st, 10th, 12th and 13th; Savannah, Ga., 2nd, 3rd, 5th, 6th, 8th, 9th, 26th and 27th; Cambridge, Mass., 30.

**Earthquakes.**—1st, Md., Latonsville, about 11 p. m.; also at Sandy Springs, at 10:45 p. m.; Brookville, Laurel and other points in Prince George's County, 20th or 21st. Yuma, Arizona, 7th, 10 p. m. 19th, Los Angeles, Cal., 4th, 2 p. m. 10th, a shock, resembling that of an earthquake, was distinctly felt at the following places: in New Jersey at Trenton, Hamilton Square, Allentown, Bordertown, Chester, Burlington, Wrightstown, Pemberton, Mt. Holly, Beverly, Riverton; and in Pennsylvania at Bristol, Torresdale, Bustleton, Germantown, Abington, Mt. Airy, Manayunk, Ashbourne and Roxburgh. Nearly all report the time as 9:59 a. m., the shock lasting from 30" to 40" and having an apparent southwest or southeast direction. Hulmeville, Pa., reports shock lasting 5 to 7 seconds from W to E. It was accompanied by a rumbling noise like moderate thunder; its intensity gradually increasing, and ranging from a gentle tremor to a force, making windows rattle and shaking fruit from trees. The track of country over which it was felt extended from a little north of Trenton to Philadelphia, or about 35 miles long by about 20 miles wide; its longitudinal axis corresponding with its apparent track. Possibly this phenomena was due to a passing meteor. 29th, Campo, Cal., at 2:30 p. m., shock lasting five seconds, accompanied by low rumbling. Advices from Callao, September 1st, and Valparaiso, August 18th, report earthquake shocks being continuously felt in some of the southern ports. Shocks of an alarming nature were felt, August 23d, at Cobija, Bolivia, at 1:40 p. m., and at Iquique at 5 p. m., and a few days earlier at Copiapo, Chili.

**Volcanic Eruptions.**—Advices from Kilauea, Hawaii, state that the crater, during the first weeks of September, was very active and brilliant. On the 10th the Old South Lake was about 1,000 feet in length and 600 feet wide, boiling and spouting.

## SOLAR PHENOMENA.

**Sun spots.**—The following observations, made by Mr. D. P. Todd, upon the spots of the sun, have been kindly communicated by Rear Admiral John Rodgers, U. S. N., Superintendent of the Naval Observatory:

Sept., 1877.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 5 p. m...	0	0	0	0	0	0	0	0	Brilliant faculae.
2nd, 5 p. m...	0	0	0	0	0	0	0	0	
3rd, 6 p. m...	1	2	0	0	1	2	1	2	
4th, 8 a. m...	0	0	0	0	0	0	1	2	
4th, 4 p. m...	0	0	0	0	0	0	1	2	
8th, 6 p. m...	0	4	0	0	0	0	1	6	
9th, 4 p. m...	0	3	0	0	0	0	1	9	
12th, 6 p. m...	1	1	0	2	1	1	2	6	
13th, 11 a. m...	1	4	1	5	1	2	2	5	
16th, 3 p. m...	0	0	0	0	0	0	2	5	
17th, 11 a. m...	0	7	0	0	0	0	2	12	Many of the spots small.
19th, 3 p. m...	0	6	0	0	0	0	2	18	
21st, 11 a. m...	0	0	1	2	0	0	1	6	
22nd, 10 a. m...	1	4	0	0	0	0	2	10	
24th, 11 a. m...	0	0	0	0	0	0	0	0	
23th, 11 a. m...	2	3	0	0	1	2	2	3	
26th, 11 a. m...	0	0	0	0	0	0	2	3	
27th, 3 p. m...	0	0	1	1	0	0	1	2	
29th, noon.....	0	0	0	0	0	0	1	1	
30th, 3 p. m...	0	1	0	0	0	0	1	2	



## NOTES AND EXTRACTS.

In the "Zeitschrift für Meteorologie," XII, page 312, Dr. J. Hann gives a very clear elucidation of recent progress in our knowledge of the origin of cyclones, and establishes the following conclusions:

"Certain atmospheric conditions must prevail over a large part of the earth's surface before an extensive whirl-wind or cyclone can be formed; conditions which must favor an inflow of air from opposite sides towards a place of diminished atmospheric pressure, (an extensive though slight barometric depression) and favor a rotary movement. Such conditions often exist in the Bay of Bengal at the time of changes of the monsoons, and in winter, over the North Atlantic ocean, where, by reason of the general distribution of pressure, the atmosphere has a tendency to a cyclonic movement. An extended, though perhaps slight barometric depression is of itself formed between two areas of high pressure, and as a consequence of the tendency of the air to cyclonic movement. A relatively high temperature and saturation of the air with aqueous vapor can also cause a gradual diminution of atmospheric pressure, which (when the distribution of pressure over a large area favors a convergence of the air from all sides) can give occasion for the formation of a cyclone. The introduction of a sufficient condensation of vapor, seems to favor the formation of the whirl, but especially to favor its continuance, and perhaps also its progressive motion, in that it allows an easy upward flow of the air that is streaming in from all sides towards a central space, because it materially increases its ascensional power. But the precipitations in the central portions of cyclones are not their especial cause, (even if these latter are, particularly over the sea, constantly accompanied thereby) because the ascent of air cannot take place, except in very rare cases, without a partial condensation of its aqueous vapor.

"The reason why slight differences of pressure give occasion to storms of hurricane violence so soon as an opportunity is offered for the formation of a whirl, is found in the concentration of the living force of a great mass of air set in motion about the axis of the whirlwind. The greater the area over which the air is set in motion so much greater is the sum total of the living force in the central part of the storm area, but the growth of this area finds a regulator in the development of the centrifugal force and in the deviation due to the earth's rotation, both of which divert a portion of the actual energy into the potential energy of a steeper gradient.

"The preexisting opposing winds affect the formation of a cyclone only in this, that they give the impulse towards a cyclonic movement, but their intensity has little or no importance. In conclusion, a few remarks upon the role which is played in atmospheric phenomena by the heat of condensation of aqueous vapor. This seems frequently to give occasion to misunderstandings. It is not correct to speak of 'the disengagement of vast quantities of heat into the air.' Nor is it proper to say 'an unknown portion of the heat given off during the process of condensation, is undoubtedly radiated off into space. Some portions of it must, however, be absorbed by the surrounding air.' The latent heat of the condensed vapor is by the ascent of the moist air immediately converted into the work of expansion; there is no increase of temperature, neither in the ascending air nor in its neighborhood. The apparent increase of temperature is explained by the fact that ascending moist air cools more slowly than dry air. After the condensation of its vapor the air must, of necessity, be cooler than before. The part which the latent heat of condensation plays consists simply in the diminution of the rate of cooling. Ascending moist air can thus retain up to much higher elevations an excess of temperature above that of its surroundings, which excess retains for it its ascensional power, and increases the intensity of the ascending current."

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*Albert J. Myer*

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